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(11) **EP 0 852 148 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
08.07.1998 Bulletin 1998/28

(21) Application number: 97100106.0

(22) Date of filing: 07.01.1997

(51) Int. Cl.<sup>6</sup>: **A61L 15/46**, D06M 16/00,  
D06M 13/33, D06M 13/46,  
D06M 13/322, D06M 13/335,  
D06M 13/432, D06M 13/477,  
D01F 1/10, D21H 21/36

(84) Designated Contracting States:  
**AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC  
NL PT SE**  
Designated Extension States:  
**AL LT LV RO SI**

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Remarks:  
Amended claims in accordance with Rule 86 (2)  
EPC.

(54) **Products having anti-microbial activity**

(57) The invention provides a dry, disposable, polymeric anti-microbial-applying product having sustained-release antimicrobial activity, the product consisting essentially of a polymeric material selected from the group consisting of natural polymers, man-made polymers, and mixtures thereof, in the form of fibers, yarns, woven, non-woven and knitted fabrics, sheets and films; and an amine salt anti-microbial agent, wherein the anti-microbial agent is releasably impregnated into the polymeric material, coated on the polymeric material, or a combination thereof, without an intermediary adhesive or linking agent and the anti-microbial agent is releasable from the polymeric material in anti-microbially effective amounts for a period of at least three days upon the anti-microbial product being brought into contact with a moist surface.

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## Description

The present invention relates to a dry, disposable, polymeric material having sustained-release, anti-microbial activity.

5 Numerous pathogens are present on the human skin. In general, and specifically in a hospital environment, it is desired that the growth of disease-producing microorganisms be inhibited and preferably that they be destroyed, so as to control patient infection and encourage wound healing. As a result, the application to the skin surface of topical, bactericidally active agents has become a standard part of the aseptic hospital technique.

10 The topical applications of broad-spectrum antimicrobials have been in the form of preoperative skin preparations, surgical scrub tissues as described, e.g., in U.S. Patent 4,045,365, washes, wound cleansers, lotions, and ointments. In some instances, such a delivery is effective to the particular purpose for a limited period of time. Microorganisms that may have survived the initial application of the antimicrobial agent act as seeds, in some instances causing the pathogen population to rise to its initial level. Continuous application of an antimicrobial agent to the site is a means of inhibiting such an increase.

15 While numerous biologically active agents have been incorporated into adhesive layers on a substrate to provide a continuous application to the body of the agent, there has been no incorporation of a broad-spectrum antimicrobial into an adhesive layer which has been characterized by stability and unaltered activity of said antimicrobial. Examples of various agents that have been incorporated into adhesives are found in U.S. Patent 2,137,169, in which phenol, thymol, methanol, etc. are added to a starch adhesive; U.S. Patent 3,249,109, in which benzocaine was added to a tacky gelatin; U.S. Patent 3,632,740, in which a corticosteroid is added to an adhesive; U.S. Patent 3,734,097, in which a micro-encapsulated, anti-neoplastic agent is added to an adhesive; U.S. Patent 4,073,291, in which Tretinoin® is added to an adhesive; U.S. Patent 3,769,071, in which 5-fluorouracil is incorporated into an adhesive; and U.S. Patent 3,896,789, in which retinoic acid is incorporated into a pressure-sensitive adhesive tape.

25 Thus, e.g., U.S. Patent 4,310,509 teaches and claims a pressure-sensitive adhesive composition which releases an antiseptically active, broad-spectrum antimicrobial when placed in contact with skin, comprising an antiseptically active amount of a broad-spectrum antimicrobial agent and a dermatologically acceptable, room temperature tacky, pressure-sensitive adhesive which is chemically compatible with said broad-spectrum antimicrobial, said broad-spectrum antimicrobial agent being homogeneously and stably dispersed in said pressure-sensitive adhesive.

30 Similarly, U.S. Patent 4,460,369 teaches and claims an adhesive, bacteria-proof wound dressing which, in use, consists essentially of a polyurethane sheet material which is 40 microns or less in thickness, having upon one surface a continuous layer of adhesive comprising a polyvinyl ether adhesive or an acrylic adhesive up to 75 microns in thickness, which adhesive has incorporated in it, in uniform known amount per unit area, a solid antibacterial material in a finely divided form, in an amount of from 1-25% by weight of the adhesive, so that the dressing is liquid-impervious but has high moisture vapour permeability and releases the antibacterial material in an amount sufficient to kill bacteria in the wound and in the surrounding covered skin area.

U.S. Patent 4,035,146 teaches the binding of antimicrobial compounds to a hydroxyl substrate using a cyanuric chloride linking agent; U.S. Patent 4,122,158 teaches a method of treating a burn on an animal by administering a contact composition comprising a hydrophobic, bioerodable polymer containing a therapeutic agent wherein said polymer bioerodes over time, releasing said therapeutic agent.

40 With the above state of the art in mind, it is an object of the present invention to prepare antimicrobial, dry, disposable materials which are substantially free of adhesives, carriers, linking agents and other foreign elements which might interfere with the prolonged action of the antimicrobial agent.

More specifically, according to the present invention there is now provided a dry, disposable, polymeric anti-microbial-applying product having sustained-release antimicrobial activity, said product consisting essentially of a polymeric material selected from the group consisting of natural polymers, man-made polymers, and mixtures thereof, in the form of fibers, yarns, woven, non-woven and knitted fabrics, sheets and films; and an amine salt anti-microbial agent; wherein said anti-microbial agent is releasably impregnated into said polymeric material, coated on said polymeric material, or a combination thereof, without an intermediary adhesive or linking agent, and said anti-microbial agent is releasable from said polymeric material in anti-microbially effective amounts for a period of at least three days upon said

50 anti-microbial product being brought into contact with a moist surface.

In particular, the present invention provides a group of dry, disposable, medical dressings or supports produced from only two components: a polymeric material and an amine salt antimicrobial agent having a sustained-release activity towards *S. aureus*, *S. epidermidis*, and *E. coli* for a period of at least five days after contact with a moist or wet surface. A fully effective sustained-release activity lasts even for periods beyond twenty days, as exemplified hereinbelow.

55 The sustained-release activity of the products of the present invention is stable and fully effective (100%), working both after being treated at 134°C for 15 minutes in a steam autoclave, and at room temperature without such treatment.

Thus, the term "stable" as used herein is intended to denote that the materials of the present invention retain their

bioactivity even after heating.

The shelf life of unwrapped products according to the present invention was tested over a period of three years. The antimicrobial slow-release activity of these products, when tested after such exposure, was 100% effective.

The materials envisioned for use in the present invention and to which the amine salt antimicrobial agents have been successfully directly bound, without the need for adhesives, linking agents, or other carriers, are natural polymers such as cotton yarn, paper, man-made polymers such as viscose (nylon and rayon) cellulose triacetate, polypropylene, polyethylene, nylon, and blends thereof

Said antimicrobial agent can be any suitable broad spectrum amine salt antimicrobial, such as benzyl dimethyl hexocyl ammonium chloride, benzalkonium chloride, cetyl pyridinium chloride (monohydrate), chlorohexidine hydrochloride, chlorohexidine gluconate, septabididecyl dimethyl ammonium bromide (carbamide clatharate).

In preferred embodiments of the present invention, said antimicrobial agent is a chlorohexidine, and provides sustained-release activity against *Staphylococcus aureus* for at least eleven days, and even for periods beyond twenty days, as exemplified hereinbelow. In this context, it is worth mentioning that chlorohexidine (CHX) in aqueous solution was found to completely inactivate (100%), in 15 seconds, all human immunodeficiency virus type I, as reported in "Recommendation for Prevention of HIV Transmission in Health Care Settings: Morbidity and Mortality Report," CDC Report, Vol. 36, pp. 987-999 (1987). Such findings add to the known data of the broad range antimicrobial activity of chlorohexidine, as reported, e.g., in J.F. Gardner and K.G. Gray, "Chlorohexidine," in Disinfection Sterilization and Prevention, S.S. Block, Ed., Lea & Febiger, Philadelphia, Pa., U.S.A. (1983).

While the products of the present invention might appear, in hindsight, to be both simple and obvious, the opposite in fact is true. Today, there is no dry, disposable product having sustained-release, antimicrobial activity for a period of at least three days upon being brought into contact with a moist or wet surface. Furthermore, no one either taught or suggested a simple, two-component polymeric product consisting essentially of a polymeric material and an antimicrobial agent as defined herein, having the unexpectedly superior properties which are exemplified hereinbelow.

Thus, e.g., as mentioned above, U.S. Patent 4,035,146 to Brenner, *et al.* teaches the essential presence of a cyanuric chloric linking group. It should therefore be noted that said U.S. patent constitutes a teaching of the essential use of a linking agent which is quite reactive. Furthermore, this agent, which irritates the skin, eyes and respiratory system, has an LD<sub>50</sub> of 18 mg/kg and, when free, can decompose to emit cyanide.

U.S. Patent 4,122,158 to Schmitt, also mentioned hereinabove, teaches the use of a bioerodable polymer having an active ingredient incorporated therein, said polymer and active ingredient being in turn contained in an absorbent carrier, and said agent being released with the erosion of the polymer (column 2, lines 25-27). In contradistinction thereto, the present invention does not include an intermediary, erodable polymer.

British Patent Application No. 2,109,237 similarly teaches a matrix material having a water-soluble particulate material incorporated therein, said particulate material preferably including a water-soluble glass, and said particulate material incorporating therein an active material. In contradistinction thereto, the present invention does not involve an intermediary, particulate, water-soluble material.

U.S. Patent 5,156,843 to Leang, *et al.*, also similarly teaches a functional substance retained in the pores of microscopic porous particles, which porous particles are in turn impregnated into a fabric material. In contradistinction thereto, the present invention does not involve intermediary, microscopic porous particles.

Thus, Brenner '146, Schmitt '158, the British application, and Leong '843 all teach a three-component system, involving the essential presence of a third component which is not required in the novel products of the present invention. It is clear that the complexity of preparing multi-component systems, as opposed to the simplicity of preparing a two-component system, and the disadvantage of having additional components present in such a system, prove that the prior art simply did not contemplate and, in fact, taught away from, the two-component system of the present invention.

The system of the present invention is also characterized by an unexpected superiority over the known prior art three-component systems. Thus, e.g., according to Brenner '146, the antimicrobial agents disclosed therein have an effective sustained-release for only 18 hours. In Barnes '256, the antimicrobial agents have an effective sustained-release for only 24 hours; the sustained-release agents of Schmitt '158 are effective for only 18 hours. None of these references either teaches or suggests a dry, disposable polymeric product having sustained-release, antimicrobial activity of at least three days, let alone a product having sustained release for over eleven days, as demonstrated hereinbelow in Examples 9 and 10.

In German Patent 1926856 there is described a heart protector or pillow device, having an outer leather covering and an inner, net-like material to hold teas, perfumes or medications in dry, liquid or gaseous form, for transdermal penetration to the heart area. Said German patent clearly does not teach or suggest the subject matter of the present invention.

In Japanese Patent 58-60014 there is described a composite fiber having a component with electric conductivity and a component having antimicrobial effect, which is described as being suitable for lingerie, and which therefore does not teach or suggest a product for therapeutic and antiseptic use having the advantages described herein.

European Patent Application 177126 teaches a process for incorporating a microbiocide into fibers after melt treatment of said fibers, but it does not teach a product having sustained-release properties for a period of at least 3 days, as defined herein.

The products of the present invention are produced as follows: the polymeric materials brought into contact with a solution of the antimicrobial agent by immersion, spraying, or coating, etc.; the solvent is separated from the treated polymeric material by soaking, evaporation, or centrifugation, etc., and the polymeric materials are then dried by utilizing forced hot air, oven drying, air at room temperature, microwave drying, or the use of heated drying drums, vacuum chambers, etc.

For example, the fabric is immersed in a tub containing a diluted antimicrobial agent at room temperature. In a continuous process, the fabric is partially dried by being pressed with a padder. Drying is done by a drier, i.e., a hot air blowing chamber or a hot drum chamber, heated up to 120°C. The speed of the continuous process is synchronized, and a winding machine then winds the processed fabric. The products are used as dressings or supports, to minimize the level of microbial contamination or to prevent the exposure of the injured site to additional microorganisms.

While the invention will now be described in connection with certain preferred embodiments in the following examples so that aspects thereof may be more fully understood and appreciated, it is not intended to limit the invention to these particular embodiments. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the scope of the invention as defined by the appended claims. Thus, the following examples which include preferred embodiments will serve to illustrate the practice of this invention, it being understood that the particulars shown are by way of example and for purposes of illustrative discussion of preferred embodiments of the present invention only and are presented in the cause of providing what is believed to be the most useful and readily understood description of formulation procedures as well as of the principles and conceptual aspects of the invention.

#### EXAMPLE 1

A matrix made of cotton gauze 75 mm wide, in accordance with the British Pharmacopoeia, was soaked in 0.5% chlorohexidine gluconate (CHXG) aqueous solution at 25°C and dried by forced hot air at 60°C in a continuous process. The antimicrobial activity of the product was tested on lawns of several bacteria: *Staphylococcus aureus* (SA), *S. epidermidis* (SE), *Escherichia coli* (EC) and *Pseudomonas aeruginosa* (PA), inoculated on agar plates, by placing a sample of about 2 cm<sup>2</sup> on the surface of the plate, and measurement of the inhibition zone after growth of the bacteria for 18 hours at 37°C. After 24 hours, the sample was passed sequentially to another inoculated agar plate and the inhibition zone measured. This daily transfer procedure continued up to the loss of growth-inhibiting activity. The results are summarized below in Table 1.

The data set forth in the Tables herein is presented as follows:

- a = no inhibition
- b = partial growth inhibition under matrix
- c = total growth inhibition under matrix
- d = growth inhibition beyond the matrix, but at less than 1 mm
- E x-y = growth inhibition in mm;
- x = minimum distance;
- y = maximum distance.

TABLE 1

Microorganism Growth Inhibition					
Passage No.	Hr	SA	SE	EC	PA
1	1	E 4-5	E 4-5	E 4-5	c
2	42	E 4-5	E 1-2	E 2-4	a
3	90	E 1-2	a	c	

#### EXAMPLE 2

A matrix made of stretch gauze fabric consisting of nylon, viscose rayon and medically bleached cotton, in accordance with the British Pharmacopoeia, was soaked in 2% chlorohexidine gluconate aqueous solution at 25°C and dried by forced hot air at 60°C in a continuous process. When tested for efficacy against SA, growth of the bacteria was inhibited.

ited for 9 passages, made sequentially during a period of 29 days.

### EXAMPLE 3

#### 5 Paper Products

Filter paper strips, made of ordinary filter paper, or of Whatman #1 and #4 (Whatman Ltd.), were exposed to chlorhexidine gluconate solutions and were dried under the aforementioned conditions. Their antimicrobial activity was assessed as described in Example 1. The results are given below in Table 2.

TABLE 2

Filter Paper	Antimicrobial Agent Conc. %	Microorganism Growth Inhibition (mm)			
		SA	SE	EC	PA
Regular	0	0	0	0	0
	1	E 5-6	E 3-4	E 4-5	E 0-1
	5	E 5-6	E 4-5	E 4-5	E 2-3
Whatman #1	0	0	0	0	0
	1	E 4-5	E 4-5	E 4-5	E 1-1
	5	E 5-6	E 4-5	E 4-5	E 2-3
Whatman #4	0	0	0	0	0
	1	E 5-6	E 3-4	E 4-5	E 1-2
	5	E 5-6	E 4-5	E 4-6	E 2-3

### EXAMPLE 4

#### Yarns

Yarns made of cotton, viscose, and nylon were soaked in aqueous solutions of chlorhexidine hydrochloride (CHXH) or chlorhexidine gluconate (CHXG), dried, and their antimicrobial activity tested. The results obtained with yarns treated with chlorhexidine hydrochloride (0.1%) are presented in Table 3.

TABLE 3

Matrix	Growth Inhibition of SA	
	24 hr	144 hr
Viscose	E 3	E 3
Cotton	E 1-2	E 1-2
Nylon	E 1	Only under the yarn

### EXAMPLE 5

#### Polymers

Cellulose triacetate, polypropylene, polyethylene and nylon were treated as above with chlorhexidine hydrochloride 0.1% or chlorhexidine gluconate 1.0%, and their antimicrobial activity was tested. The results are summarized in Table 4.

TABLE 4

<u>Matrix</u>	<u>Antimicrobial Agent</u>	<u>Microorganism Growth Inhibition</u>			
		<u>SA</u>	<u>SE</u>	<u>EC</u>	<u>PA</u>
Cellular triacetate	CHXH	E 5-6	E 3-4	E 2-4	E 1-2
	CHXG	E 4-5	E 4	E 3-4	E 1
Polypropylene	CHXH	E 2-4	E 1-2	E 1-3	a
	CHXG	E 2-5	E 2-3	E 2-4	a
Polyethylene	CHXH	E 3-4	E 2	E 1-3	a
	CHXG	E 3-5	E 3	E 2-3	E 1
Nylon	CHXH	E 3-4	E 2-3	E 2-3	a
	CHXG	E 3-5	E 2-3	E 2-4	d

**EXAMPLE 6**Non-Woven Matrix

A non-woven matrix, made of polyethylene, viscose and cotton (Sion, Israel), used as pads for nursing mothers to protect the nipples, was treated as above with various chlorohexidine gluconate concentrations. Their antimicrobial activity is summarized in Table 5.

TABLE 5

<u>CHXG Concentration (%)</u>	<u>Microorganism Growth Inhibition</u>			
	<u>SA</u>	<u>SE</u>	<u>EC</u>	<u>PA</u>
2	E 5-7	E 3-5	E 2-3	d
5	E 4-5	E 4-5	E 3-4	E 1-2

**EXAMPLE 7**

Dressing, treated as above in Example 1, but with 2% chlorohexidine gluconate, was incubated for 30 days at 55°C and the antimicrobial activity was compared with that of a dressing incubated at room temperature. Fig. 1 shows the antimicrobial activity tested against *S. aureus* (A); *S. epidermidis* (B); *E. coli* (C), and *P. aeruginosa* (D), with relation to a control non-treated dressing (1); yarn (2); a treated dressing stored at room temperature (3); yarn from a treated dressing stored at 55°C (4); and a treated dressing stored at 55°C (5).

As is seen from the zones of inhibition in Fig. 1, dressings and the yarns from which they are made, stored at 55°C for 30 days, retain antimicrobial activity similar to that of those stored at room temperature.

**EXAMPLE 8****Spill of Contaminated Body Fluid**

5 The product will be a dressing on a wound or a disposable lab coat, which will be exposed to a spill of the contaminated body fluid of an AIDS patient. Since chlorohexidine was demonstrated to be viricidal to HIV, and the site of the spill is an aqueous environment, the HIV reaching the matrix will most probably be killed and the chance for HIV infection of the bearer will be eliminated.

**EXAMPLE 9**

Radioactive chlorohexidine hydrochloride (CHXH) was prepared by the introduction of  $^3\text{H}$  tritium in the molecule. 0.01 g of a matrix made of cotton gauze was soaked for 30 minutes in radioactive chlorohexidine hydrochloride aqueous solution. The excess of CHXH solution was washed out from the matrix by rinsing the sample for 30 minutes in 20 ml L.B. medium. After that, the sample was washed three more times in 5 ml L.B. medium, for 1 minute each time.

To measure the release of CHXH from the sample, the following experiment was carried out:

The sample was placed in a 5 ml L.B. medium for 24 hours. The amount of CHXH released in the solution was measured by radioactivity measurement. The sample was placed in a new solution of 5 ml L.B. medium. The experiment was repeated 20 times. After 20 days, the experiment was stopped. The sustained-release was almost linear. During the 20 days, only about 4% of the amount of CHXH contained in the gauze after washing 3 times was released, indicating that the preponderance of CHXH was still retained in the gauze for further sustained release.

**EXAMPLE 10****Wound Healing**

Standard sized wounds were formed under anesthesia on the backs of guinea pigs (250-450 gr). The wounds were inoculated with *S. aureus* and covered with sterile pads. 55 minutes after inoculation, the wounds were treated by placing on them dressings made of either the fabric described in Example 1, but treated with 1% chlorohexidine gluconate, or an equally-sized gauze pad, wetted with Savior (ICI) or Polydin solution. After 11 days of daily replacement or the treated pads, or retention of the originally-applied single pad for 11 days, the wound areas were measured and the results were tabulated in Table 6, as set forth below.

TABLE 6

	% Unhealed Wound Area (cm <sup>2</sup> )			
	Daily Application		Single Application	
	4 Days	10 Days	4 Days	10 Days
Pad wet with Savior	0.80	0.40	1.07	0.60
Matrix as prepared in Example 1	0.78	0.38	0.18	0
Pad wet with Polydin	0.78	0.40	0.60	0.40

As seen in Table 6, the best wound healing (statistically significant by T test) was in the group of animals treated with the matrix of Example 1 and by single application. The second best results were with the other group of animals treated with the matrix of Example 1 but replaced each day. These results clearly indicate the superiority and durability of sustained-release for a period of many days.

**EXAMPLE 11****Matrix:**

A standard woven matrix, manufactured by Shirley Development, Ltd., of England, consisting of six strips in which each strip is made of a different fiber, was utilized in this example. The following are the six various fibers in the woven matrix, and their identifying initials:

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CD Secondary cellulose acetate (dicel)  
C Bleached unmercerized cotton  
N Nylon 6.6  
P Polyester (terylene)  
5 A Acrylic (courtelle)  
W Worsted wool

### Procedure:

10 The matrix, consisting of the six above-mentioned fabrics, was soaked at 25°C in a 2% chlorohexidine gluconate aqueous solution and dried by forced air at 100°C in a continuous process.

The processed matrix was separated into six segments, each comprising one of the various fabrics. The anti-microbial activity of each segment was separately tested, as described above in Example 1. The results are given below in Table 7.

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TABLE 7

	Fabric	Transfer No.	Microorganism Growth Inhibition			
			SA	SE	EC	PA
5	CD	1	E 3-4	E 2-3	E 2-3	E 0-1
	C	1	E 3-4	E 2-3	E 2-3	E 0-1
10	N	1	E 3-4	E 2-3	E 2-3	a
	P	1	E 3-4	E 2-3	E 2-3	E 0-1
	A	1	E 3-4	E 2-3	E 2-3	E 0-1
15	W	1	E 3-4	E 2-3	E 2-3	c
	CD	6	E 2-3	E 0-1	E 1-2	
	C	6	E 2-3	E 2-3	E 2-3	
20	N	6	a	a	a	
	P	6	E 2-3	E 2-3	E 2-3	
	A	6	E 2-3	E 2-3	E 2-3	
	W	6	E 2-3	E 2-3	E 2-3	
25	CD	7	E 2-3	c	E 1-2	
	C	7	E 2-3	c	E 2-3	
	N	7	a	a	a	
30	P	7	E 2-3	c	E 2-3	
	A	7	E 2-3	c	E 2-3	
	W	7	E 2-3	c	E 2-3	
	After washing:					
35	CD	1	E 2-3	E 0-1	E 1-2	a
	C	1	E 2-3	E 1-2	E 1-2	E 0-1
	N	1	E 0-3	a	E 0-1	a
	P	1	E 2-3	a	E 0-1	a
40	A	1	E 1-3	a	E 0-1	a
	W	1	E 2-3	E 0-1	E 1-2	a
	Stability -A Comparison:					
45	C -Unsterilized, treated with CHGH		E 3-4	E 2-3	E 2-3	E 0-1
	C - Sterilized, treated with CHGH (autoclaved 134°C, 15 min)		E 3-4	E 2-3	E 2-3	c

**EXAMPLE 12**

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The procedure of Example 1 was repeated with the following amine salt anti-microbial agents, having the indicated identifying code numbers:

- 844 Cetyl pirdinium chloride  
 846 Bacitracin  
 861 Benzyl dimethyl hexocylammonium chloride  
 868 Septabididecyl dimethyl ammonium bromide  
 836 Chlorohexidine gluconate

The anti-microbial activity of each of the products was tested on lawns of Staphylococcus aureus (SA). The results are summarized in Table 8 below:

TABLE 8

	<u>Antimicrobial Agent</u>	<u>Growth Inhibition SA</u>
<u>Day 1</u>	844	E 3-4
	846	E 4-6
	861	E 3-5
	868	E 5-6
	836	E 4-5
<u>Day 2</u>	844	E 5-6
	846	E 1-3
	861	E 3-4
	868	E 5-6
	836	E 3-4
<u>Day 3</u>	844	E 3-4
	846	b
	861	E 3-4
	868	E 4-5
	836	E 2-3
<u>Day 4</u>	844	E 2-4
	846	b
	861	E 2-3
	868	E 3-4
	836	E 2-3

It will be evident to those skilled in the art that the invention is not limited to the details of the foregoing illustrative examples and that the present invention may be embodied in other specific forms without departing from the essential attributes thereof, and it is therefore desired that the present embodiments and examples be considered in all respects as illustrative and not restrictive, reference being made to the appended claims, rather than to the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

#### Claims

1. A dry, disposable, polymeric anti-microbial-applying product having sustained-release anti-microbial activity, said product consisting essentially of:

a polymeric material selected from the group consisting of natural polymers, man-made polymers, and mixtures thereof, in the form of fibers, yarns, woven, non-woven and knitted fabrics, sheets; and an amine salt anti-microbial agent;

wherein said anti-microbial agent is releasably impregnated into said polymeric material, coated on said polymeric material, or a combination thereof, without an intermediary adhesive or linking agent, and said anti-microbial agent is releasable from said polymeric material in anti-microbially effective amounts for a period of at least three days upon said anti-microbial product being brought into contact with a moist surface.

2. A dry, disposable, anti-microbial-applying product according to claim 1, wherein said amine salt anti-microbial agent is selected from the group consisting of chlorohexidine gluconate, chlorohexidine hydrochloride, benzyl dimethyl hexocylammonium chloride, benzylalkonium chloride, cetyl piridinium chloride (monohydrate), and sept-  
5 abicididecyl dimethyl ammonium bromide (carbamide clatharate).
3. A dry, disposable, polymeric anti-microbial-applying product according to claim 1, wherein said salt anti-microbial agent is directly impregnated into said polymeric material.
4. A dry, disposable, polymeric anti-microbial-applying product according to claim 1, wherein said anti-microbial agent  
10 is chlorohexidine hydrochloride.
5. A dry, disposable, polymeric anti-microbial-applying product according to claim 1, wherein said anti-microbial agent is chlorohexidine gluconate.
6. The dry, disposable, polymeric anti-microbial-applying product of claim 1, wherein the natural polymer is cotton.
7. The dry, disposable, polymeric anti-microbial-applying product of claim 1, wherein the man-made polymer is vis-  
15 cose.
8. The dry, disposable, polymeric anti-microbial-applying product of claim 1, wherein said polymeric material is in the form of a paper sheet.
9. The dry, disposable, polymeric anti-microbial-applying product of claim 1, wherein said polymeric material is in the form of a yarn.
10. The dry, disposable, polymeric anti-microbial-applying product of claim 1, wherein said man-made polymer is  
25 selected from the group consisting of cellulose triacetate, polypropylene, polyethylene, nylon, and combinations thereof.
11. The dry, disposable, polymeric anti-microbial-applying product of claim 1, wherein said polymeric material is in the form of a non-woven fabric made from polypropylene and cotton fibers.
12. A dry, disposable, polymeric anti-microbial-applying product according to claim 1, wherein said salt anti-microbial  
30 agent is coated on said polymeric material.
13. A dry, disposable, polymeric anti-microbial-applying product according to claim 1, wherein said salt anti-microbial agent is impregnated into and coated on said polymeric material.
14. A dry, disposable, polymeric anti-microbial-applying product having sustained-release anti-microbial activity, said  
40 product consisting essentially of:
  - a polymeric material selected from the group consisting of natural polymers, man-made polymers, and mix-  
45 tures thereof, in the form of fibers, yarns, woven, non-woven and knitted fabrics, sheets; and  
an amine salt anti-microbial agent;
  - wherein said anti-microbial agent is releasably impregnated into said polymeric material, coated on said  
polymeric material, or a combination thereof, without an intermediary adhesive or linking agent, and whereby  
contact of said polymeric anti-microbial-applying product with a moist surface causes said polymeric material  
to release said anti-microbial agent in anti-microbially effective amounts for a period of at least three days.

European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number  
EP 97 10 0106

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DATABASE WPI Section Ch, Week 8810 Derwent Publications Ltd., London, GB; Class A18, AN 88-067061 XP002032176 & JP 63 020 344 A (SUMITOMO ELECTRIC IND CO), 28 January 1988 * abstract *	1-5,8, 10,14	A61L15/46 D06M16/00 D06M13/33 D06M13/46 D06M13/322 D06M13/335 D06M13/432 D06M13/477 D01F1/10 D21H21/36
X	DE 295 21 227 U (FRANZ NORBERT DR. ) 2 January 1997 * the whole document *	1,2	
A	GB 901 039 A (DU PONT DE NEMOURS AND CO.) 30 October 1958 * page 1, line 22 - line 49 * * page 2, line 110 - page 3, line 37 * * examples 6-11 *	1,6-10	
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A	EP 0 388 220 A (YISSUM RES DEV CO. ) 19 September 1990 * page 3, line 53 - page 4, line 3 *	1-3,5,8	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 4 June 1997	Examiner Herrmann, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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